
User's Manual

MC1/AC1 Single Channel Calibration Unit For use with ZR402G

IM 11M06D03-01E-A

User's Manual

MC1/AC1
Single Channel Calibration Unit
For use with ZR402G

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I. INTRODUCTION

There are two types of single channel calibration units offered by Yokogawa. These calibration units are used with the ZR402G Single Channel Oxygen Analyzer, to perform calibration of either ZR22G or ZO21D (obsolete) Oxygen Probes.

The AC1 Automatic Calibration Unit utilizes electrical solenoids that are wired to and actuated by the ZR402G. Once activated by the ZR402G, the calibration gases flow to the ZR22 without the user opening valves or adjusting flow rates. The MC1 Manual Calibration Unit is not electronically controlled by the ZR402G. During calibration mode, the user must open valves and adjust the flow rates of the calibration gases. Both the MC1 and the AC1 provide a single point of control for the calibration system.

II. OVERVIEW

2.1 CALIBRATION PRINCIPLES

This section sets forth the principles of measurement with a Zirconia oxygen analyzer before detailing calibration.

A solid electrolyte, such as Zirconia, allows the conductivity of oxygen ions at high temperatures. Therefore, when a Zirconia-plated element with platinum electrodes on both sides is heated up in contact with gases having different partial-oxygen pressures on each side, the element shows the action of the concentration cell. In other words, the electrode in contact with a gas with a higher partial-oxygen pressure acts as a negative electrode. As the gas comes in contact with the Zirconia element in this negative electrode, oxygen molecules in the gas acquire electrons and become ions. Moving in the Zirconia element, they eventually arrive at the positive electrode on the opposite side. There, the electrons are released and the ions return to the oxygen molecules.

This reaction is indicated as follows:

Negative electrode: $O_2 + 4e \rightarrow 2O^{2-}$

Positive electrode: $2O^{2-} \rightarrow O_2 + 4e$

The electromotive force E (mV) between the two electrodes, generated by the reaction, is governed by Nernst's equation as follows:

$$E = -\frac{RT}{nF} \ln \frac{P_x}{P_a} \dots \text{Equation (1)}$$

Where, **R**: Gas constant

T: Absolute temperature

n: 4

F: Faraday's constant

P_x: Oxygen concentration in a gas in contact with the positive Zirconia electrode (%)

P_a: Oxygen concentration in a gas in contact with the negative Zirconia electrode (%)

Assuming the Zirconia element is heated up to 750°C, then we obtain equation (1) above.

$$E = -50.74 \log \left(\frac{P_x}{P_a} \right) \dots \text{Equation (2)}$$

With this analyzer, the sensor (Zirconia element) is heated up to 750°C, so Equation (2) is valid. At that point, the relationship as in Figure 2.1 is effected between the oxygen concentration of the measurement gas in contact with the positive electrode and the electromotive force of the sensor (= cell), where a comparison gas of air is used on the negative electrode side.

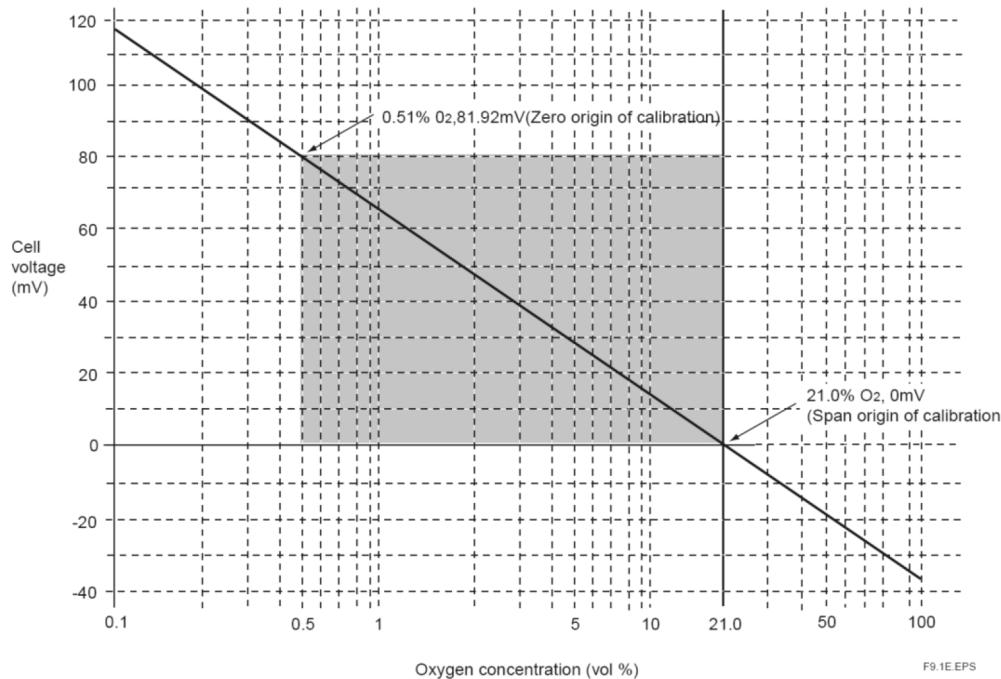


Figure 2.1

2.2 CALIBRATION GASES

2.2.1 CALIBRATION (ZERO) GAS

The calibration gas typically used is 1% oxygen balanced in nitrogen; however, an oxygen mixture between 0.4% and 8% is acceptable. A compressed gas cylinder is containing certified gas mixtures fitted with a dual stage regulator should be used. The maximum working pressure of the calibration systems (MC1 & AC1) is 35 psig. The reference gas should be clean, dry instrument air.

2.2.2 REFERENCE (SPAN) GAS

Reference air is from the same source as the span gas. The reference air flows to the backside of the Zirconia cell, and is used at all times. The calibration units are plumbed to provide a continuous flow rate of the reference, as well as, calibration gas flow during calibration. A clean, dry air source is recommended, such as instrument air. Install an inline filter before the calibration unit to remove any moisture or dirt. A regulator must be attached to the instrument air source to provide the appropriate working pressure for the calibration unit. The maximum pressure is 35 psig.

NOTE

Never use pure nitrogen for calibration.

NOTE

Compressed gas cylinders must have the same CGA connection as the dual stage regulator. Refer to the Appendix A (Spare Parts section) of this manual for the Dual Stage Regulator (M1132ZX) and the Zero Pressure Switch (M1133AR).

III. SPECIFICATIONS, MC1

3.1 MODEL MC1, MANUAL CALIBRATION PANEL

The MC1 is the manual calibration unit for a single oxygen probe. It provides regulation of the reference air and calibrations gas while allowing the operator to select zero or span gas for calibration. Separate flow meters are used to set cal gas flow rates and reference air.

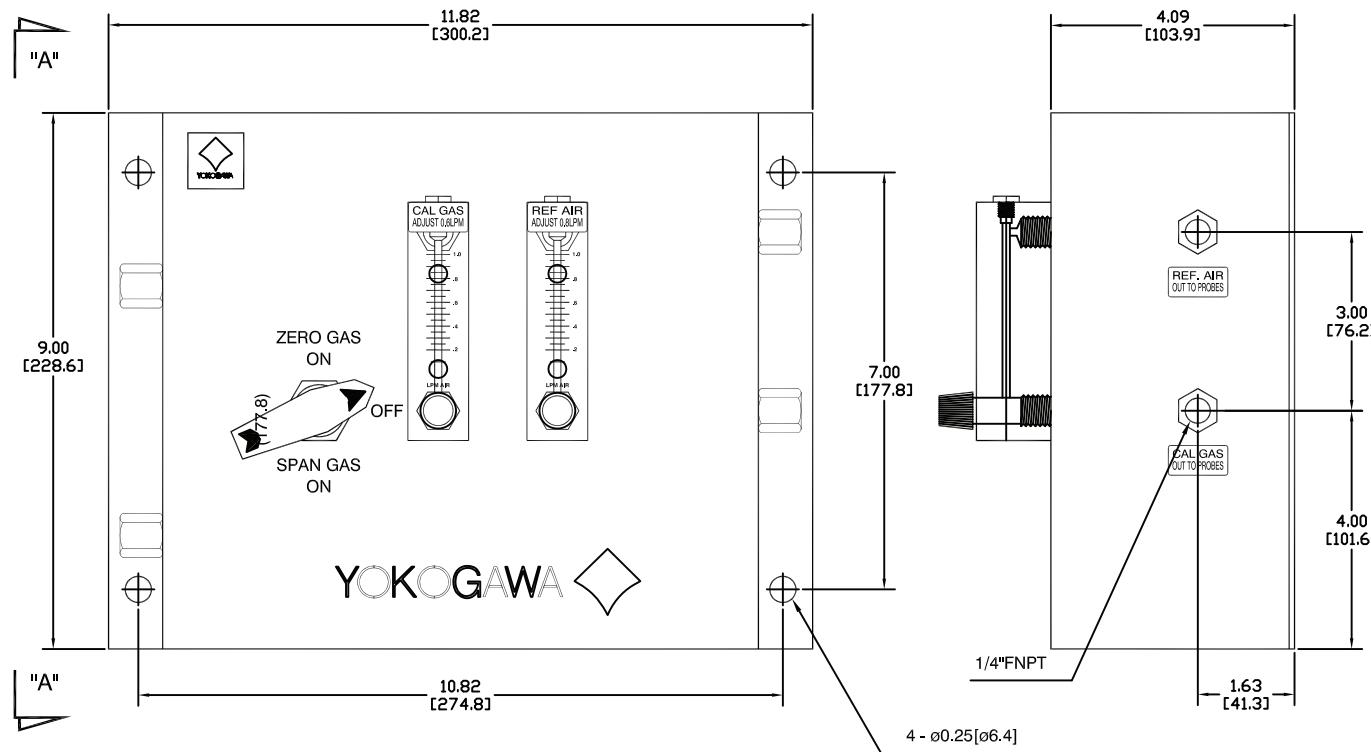


Figure 3.1

Maximum pressure:	35 psig
Calibration Plate:	Stainless Steel
Connections:	1/4" FNPT
Calibration Tubing:	1/4" Copper (standard); 1/4" Stainless Steel (optional)
Weight:	Approximately 4.4 lbs. (2 kg)
Flow rates:	Calibration gas – 0.6 LPM Reference Air – 0.8 LPM



NOTE

Exceeding the recommended flow rates will damage the detector cell.

3.1.2 ORDERING SPECIFICATIONS:

SINGLE CHANNEL O2 MANUAL CALIBRATION	
MC1	MODEL NUMBER
TUBING/FITTINGS	
-C	1/4" Copper Tubing and Brass Fittings
-S	1/4" Stainless Steel Tubing and Fittings
CODE B	
-R*U	Reference Air Flow meter

Table 3.1

3.2. SPECIFICATIONS, AC1

3.2.1 MODEL AC1, SINGLE POINT AUTOMATIC CALIBRATION UNIT

The AC1 provides control of reference air and cal gas flow rates while maintaining a constant regulation of gases. The AC1 includes individual span, zero and block solenoids with manual overrides for easy setup of flow rates. The user has a choice of copper or stainless steel tubing in addition to NEMA 4 or NEMA 4X enclosures. It also contains a 1 amp fuse with an LED indicator to indicate a power surge.

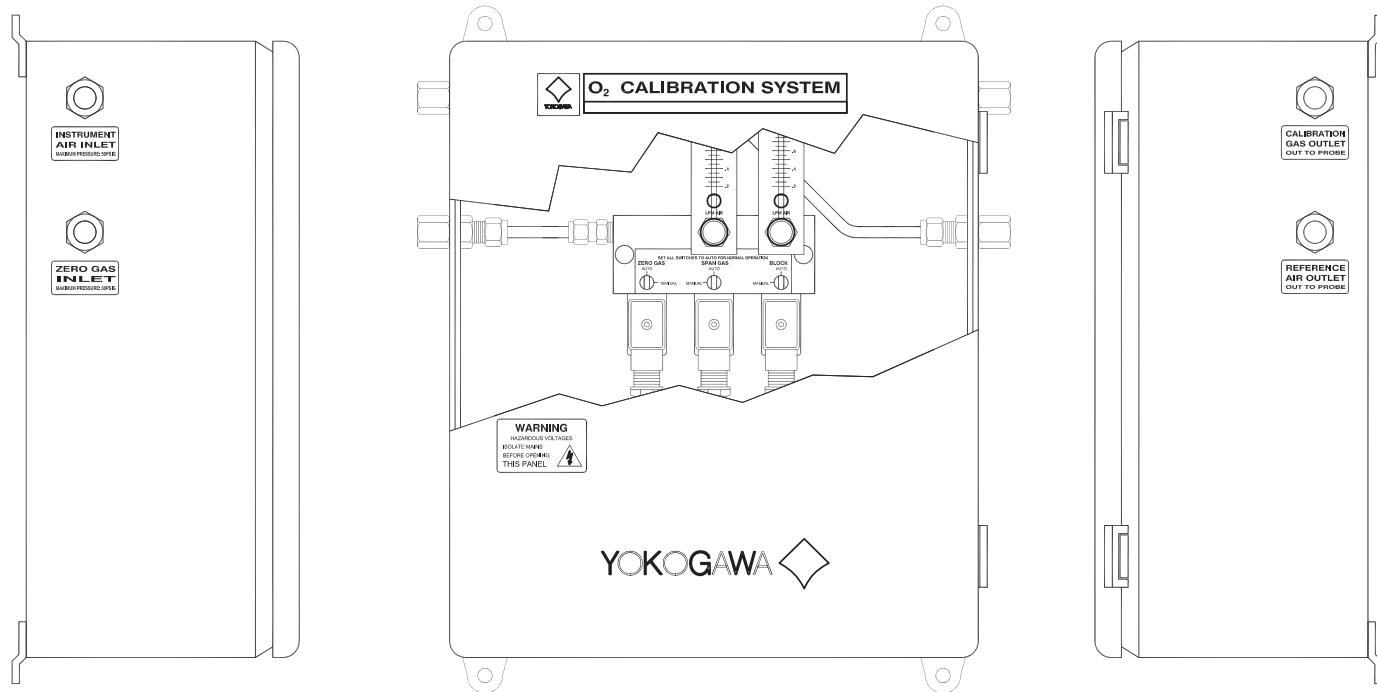


Figure 3.2

NOTE: Cutaway shows internal flow meters and solenoids

Operating Pressure: 20 psig
Maximum Pressure: 35 psig
Flow meter Range: 0.15 to 1.0 LPM (separate flow meter for cal gas and reference air).
Tubing: 1/4" Copper (standard); 1/4" Stainless Steel (optional).
Gas Connections: 1/4" FNPT
Voltage: 110 VAC, 50/60 Hz (standard).

Flow rates: Calibration gas – 0.6 LPM
Reference Air – 0.8 LPM



Exceeding the recommended flow rates will damage the detector cell.

3.2.2 AC1 ORDERING SPECIFICATIONS

SINGLE CHANNEL O2 AUTO CALIBRATION		
AC1	MODEL NUMBER	
	CODE A	ENCLOSURE
	-4	NEMA 4, Metal Enclosure
	-5	NEMA 4X, Fiberglass Enclosure
	CODE B	TUBINGS/FITTINGS
	-C	1/4" copper Tubing and Brass Fittings
	-S	1/4" Stainless Steel Tubing and Fittings
	CODE C	POWER SUPPLY
	-A	For use with ZA8C
	-D	For use with ZR402G (requires 110 VAC)
	CODE D	REFERENCE AIR CONNECTION
	-R*U	Reference Air Connection

Table 3.2

IV. INSTALLATION, MANUAL CALIBRATION (MC1)

4.1 LOCATION

The following guidelines should be used when selecting a location for the calibration unit:

- 1) Easily accessible for maintenance and inspections.
- 2) Locating the MC1 close to the ZR22 probe minimizes the amount of tubing required for plumbing. Conversely, mounting the MC1 close to the ZR402G eliminates the need for two technicians to accomplish the calibration.
- 3) Ambient temperature should not exceed 55°C (131°F).
- 4) Humidity is moderate and no corrosive gases are present
- 5) Minimal vibration
- 6) Clean, dry instrument air is available

4.2 MOUNTING THE MC1

The MC1 unit is designed for wall mounting, and can be secured using four (4) standoff and four bolts. Sufficient room should be made available for connecting the calibration and reference gas tubing.



The unit must be mounted as level as possible to ensure the accuracy of the flow rates

4.3 PIPING

Plumbing is required from the instrument air line and zero gas cylinders to the calibration unit. Standard 1/4" Stainless Steel tubing is recommended. Separate tubing for the instrument air and zero gas are connected to the 1/4" FNPT fittings on the LEFT side of the calibration unit. The input/output fittings are all 1/4"FNPT fittings, and are available in brass or stainless steel. The probe connections (calibration and reference) are located on the RIGHT. See figure 4.1



Never use pure nitrogen for calibration.



Compressed gas cylinders must have the same CGA connection as the dual stage regulator. Refer to the Appendix A (Spare Parts section) of this manual for the Dual Stage Regulator (M1132ZX) and the Zero Pressure Switch (M1133AR).

4.3.1 PIPING TO THE ZR22G OXYGEN PROBE

4.3.2 Connection to the Calibration Gas Inlet

Connect the tubing from the Zero (cal) gas output, shown in Figure 3.1, to the CAL IN side of the ZR22 probe. If the process is a positive pressure application, ensure that a check valve (Yokogawa Part Number M1234VV-A) is installed between the CAL IN port and the 1/4" tubing. The check valve may already be installed on the detector prior to shipping.

4.3.3 CONNECTION TO THE REFERENCE GAS INLET

Connect the tubing from the Reference gas output, shown in Figure 4.3, to the REF IN side of the ZR22 probe. Clean, dry instrument air is recommended as a reference (span) gas; however, ambient air may be used as a substitute.

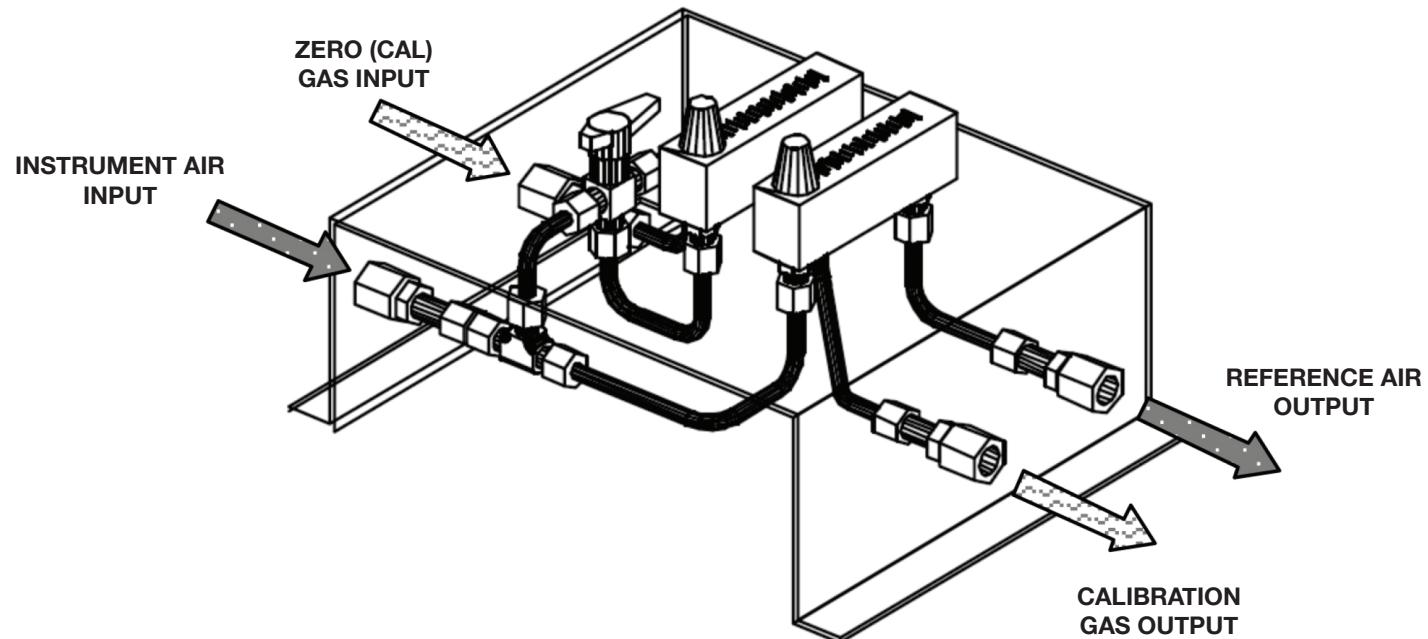


Figure 4.1

A list of recommended part for piping to the MC1 or AC1 units is listed below in Table 3.1

Calibration Unit	Piping Location	Parts	Notes	
MC1 Manual Calibration Unit AC1 Single Channel Automatic Calibration Unit	Calibration Gas Inlet	Check valve	Recommended by Yokogawa for positive pressure applications: M1234VV-A. Available through Yokogawa	
		Nipple	Rc 1/4 or 1/4 inch MNPT	General parts
		Zero Gas Cylinder	User's Scope	
		Gas Pressure Regulator	Recommended by Yokogawa: M1132KD Regulator, and M1132ME Gauge. Available through Yokogawa	
		Zero Gas Pressure Switch	Recommended by Yokogawa: M1133AR Available through Yokogawa	
		Reference gas inlet	Joint for tube connection	Rc 1/4 or 1/4 inch MNPT
				General parts

Figure 4.1

V. SETUP PROCEDURES, MC1

5.1 INITIAL FLOW RATE SETUP

Locate the reference air flow meters, and adjust the flow adjustment knobs as outlined below:

Reference Air: 0.8 LPM

Calibration Gas: 0.6 LPM



The maximum working pressure of the MC1 and AC1 unit is 35 psi. Excessive pressure can damage the Zirconia cell of the ZR22G Oxygen Probe.

5.2 MC1 FLOW RATE SETUP

Performing a calibration

For accurate calibrations, the manual calibration system must provide a fixed flow of zero and span gas during calibration. There are two flow meters and one hand valve for the MC1. The hand valve is used only during calibration to flow either span gas or zero gas to the probe, using the CAL GAS flow meter to indicate the flow rate. The REF AIR flow meter is used to flow the reference air for the ZR22 probe, and remains flowing at all times, with a flow rate of 0.8 LPM. The ZR402 display will prompt the user to perform the following steps, when programmed for One Touch (TCH) calibration:

1. Position the valve knob to SPAN GAS ON. This will start the flow of Span Gas to the probe.
2. Adjust the CAL GAS flow meter to show 0.6 LPM as the flow rate. If necessary, adjust the reference flow meter to show 0.8 LPM.
3. To stop the flow of Span gas, position the valve knob to the OFF position.
4. To start the flow of Zero gas to the probe, position the valve knob to ZERO GAS ON.
5. Adjust the CAL GAS flow meter to show 0.6 LPM as a flow rate. If necessary, adjust the reference flow meter to show 0.8 LPM.
6. To stop the flow of Zero gas, position the valve to the OFF position.



If reference air is used during calibration, the reference air must be left ON after calibration.

5.3 CHECKING FOR LEAKS

1. Position the valve to SPAN
2. Apply a leak detection spray on all compression fittings and bends of the cal line tubing for the probe, the MC1 gas inlets/outlets, and the probe inlets for CAL and REF gas.
3. Inspect the full length of the CAL and REF lines for leaks.
4. Repair leaks as necessary, and within applicable guidelines
5. After repairing the leaking areas, repeat the inspection instructions above for the affected areas.
6. Upon completion, return the valve to the OFF position, and set the Reference and Cal gas flow rates to 0.8 LPM and 0.6 LPM respectively

VI. INSTALLATION, AUTOMATIC CALIBRATION, AC1

6.1 LOCATION

The following guidelines should be used when selecting a location for the calibration unit:

- 1) Easily accessible for maintenance and inspections.
- 2) As close to the ZR22 probe as practical. This will minimize the amount of tubing required for plumbing, and decrease calibration times. Ambient temperature should not exceed 55°C (131°F).
- 3) Humidity is moderate and no corrosive gases are present



NOTE

Use an air purge for the AC1 enclosure if the corrosive gases or high dust content is present.

- 4) Minimal vibration
- 5) Clean, dry instrument air is available

6.2 MOUNTING THE AC1

The AC1 is available in a NEMA and NEMA 4X, lockable enclosure, and the unit is designed for wall mounting. It can be secured using four (4) standoffs and four (4) bolts. Mount the AC1 unit so that the terminal strip is easily visible for wiring purposes. Sufficient room should be made available for connecting the calibration and reference gas tubing.



NOTE

The unit must be mounted as level as possible to ensure the accuracy of the flow rates

6.3 PIPING

A list of recommended part for piping to the MC1 and AC1 units is listed previously in Table 4.1

6.3.1 PIPING TO THE ZR22G OXYGEN PROBE

6.3.2 CONNECTION TO THE CALIBRATION GAS INLET

Connect the tubing from the Zero (cal) gas output, shown in Figure 5.1, to the CAL IN side of the ZR22 probe. If the process is a positive pressure application, ensure that a check valve (Yokogawa Part Number M1234VV-A) is installed between the CAL IN port and the 1/4" tubing. The check valve may already be installed on the detector prior to shipping.

6.3.3 CONNECTION TO THE REFERENCE GAS INLET

Connect the tubing from the Reference gas output, shown in Figure 5.1, to the REF IN side of the ZR22 probe. Clean, dry instrument air is recommended as a reference (span) gas; however, ambient air may be used as a substitute.

6.4. WIRING TO THE AC1, AUTOMATIC CALIBRATION UNIT

6.4.1 WIRING THE AC1 TO THE ZR22G

The solenoids of the AC1 are powered by 24VDC from the ZR402G Oxygen Converter. The AC1 itself can be powered by the ZR402G if the ZR402G is using 120VAC, 60Hz. Supply voltage for the AC1 can be obtained from terminals "L, N & G" on the ZR402G. Please refer to the wiring diagram located in Appendix C.

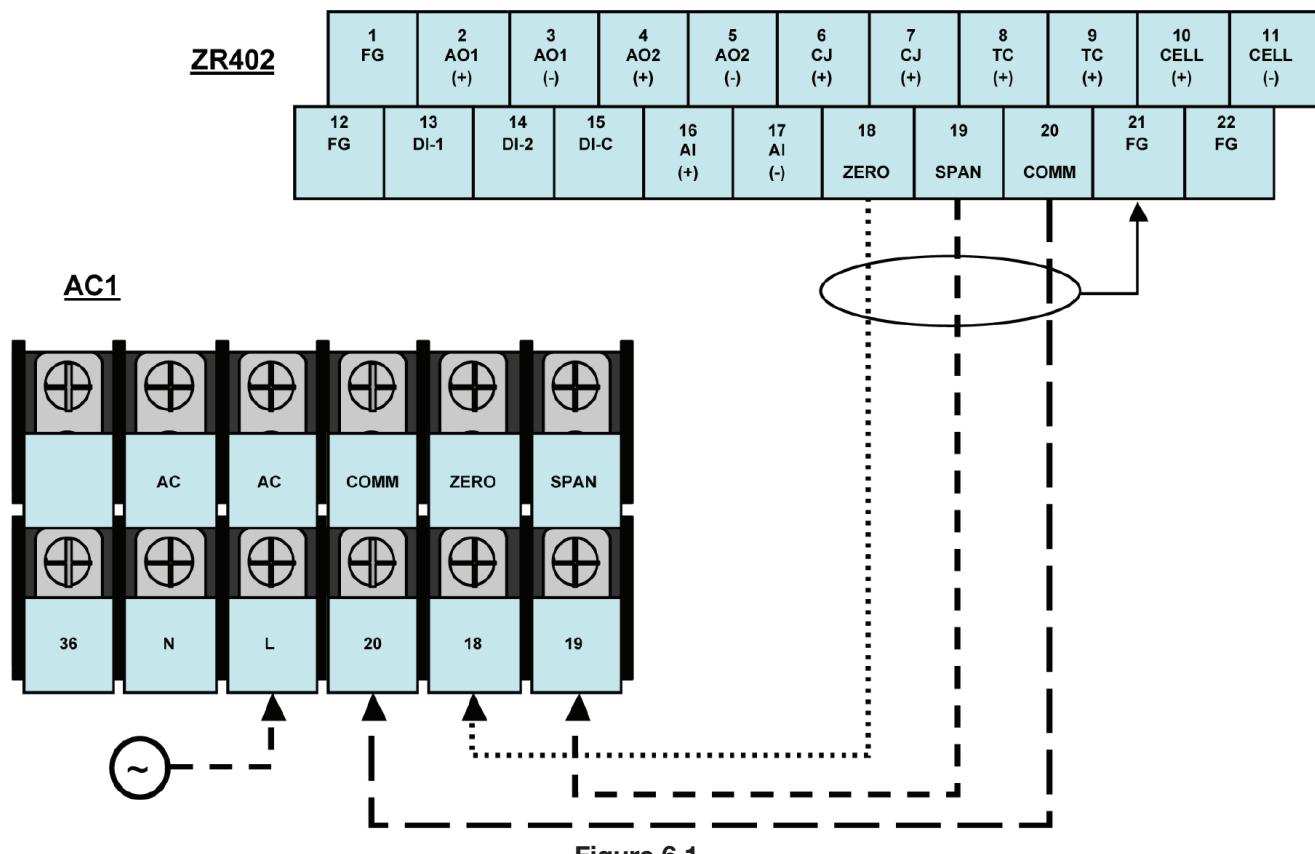

WARNING

When wiring electrical components, verify that electrical current and all applicable circuit breakers are de-energized prior to wiring the AC1 and ZR402G. Ensure that all applicable “Lock Out” and “Tagging” procedures have been adhered to. Verify the integrity of ALL electrical connections and terminations prior to energizing the system.

A 16 AWG, 4 conductor cable is recommended for use between the ZR402G and the AC1 Unit. The cable should be run in a separate conduit from the detector cables. If a conduit is not used, the wiring should have a suitable jacket to meet environmental and regulatory codes.


NOTE

To prevent noise from interfering with surrounding electrical lines, we recommend the use of shielded cable ground at the ZR402G.



VII. SETUP PROCEDURES, AC1

Locate the reference air flow meters, and adjust the flow adjustment knobs as outlined below:

Reference Air: 0.8 LPM

Calibration Gas: 0.6 LPM



CAUTION

The maximum working pressure of the MC1 and AC1 unit is 35 psi. Excessive pressure can damage the Zirconia cell of the ZR22G Oxygen Probe.

7.1 INITIAL FLOW RATE SETUP

Ensure that the calibration gas and reference air lines are properly plumbed to the left side of the AC1 Auto Cal Unit. The zero gas and instrument air should be set at approximately 20 psi (± 2 psi). Power is not required to set the flow rates.

7.1.2 SETTING THE REFERENCE AIR FLOW RATES

Locate the reference flow meters. Adjust the flow adjustment knob on the REFERENCE AIR FLOW METER to 0.8 LPM or 800ml/min.

7.1.3 BALANCING PRESSURE DROPS IN THE CALIBRATION LINES

For accurate calibrations, the auto cal system must provide a fixed flow of Zero gas and Span gas. To balance the pressure drops perform the following steps:

- 1) Locate the BLOCK and SPAN GAS SOLENOID. Using a screwdriver, turn the override screw to the manual position. See Figure 5.2
- 2) Use the flow regulator knob on the CAL GAS FLOW METER to adjust the flow to 1.0 LPM.
- 3) Switch the override screw of the SPAN GAS solenoid to AUTO.
- 4) Turn the override screw for the ZERO GAS solenoid to MANUAL.
- 5) Adjust the pressure regulator on the zero gas cylinder for a flow of 1.0 LPM on the Calibration Gas flow meter.



CAUTION

DO NOT USE the flow regulator knob of the flow meter to achieve this flow level.

- 6) Adjust the flow regulator knob on the Calibration Gas flow meter until the flow meter reads 0.6 LPM.
- 7) Verify that all the manual overrides are set back to AUTO.

7.2 STANDARD OPERATION

- The Reference Air Flow meter indicates 0.8 LPM during normal operation and calibration.
- All manual overrides are set to the AUTO position.
- The Calibration Gas flow meter will show a flow of 0.6 LPM during Calibration only.

Before considering your calibration unit automated, it is good practice to check for leaks along the full distance of the calibration line tubing, in addition to performing a CAL CHECK to confirm that the gases are plumbed correctly to each probe.

7.3 CHECKING FOR LEAKS



To prevent leakage, all threaded connections should have Teflon tape (or suitable alternative) and all compression fittings should be installed per manufacturer's recommendations.

1. Locate the BLOCK SOLENOID. Turn the override screw on the BLOCK SOLENOID and SPAN SOLENOID to the manual position.
2. Use leak detection spray on all compression fittings and bends of the cal and reference line tubing.
3. Inspect the full length of the tubing to determine if there is a leak.
4. Repair leaks as necessary, and within applicable guidelines.
5. After repairing the leaking areas, repeat the inspection instructions above for the affected areas.
6. Upon completion of repairing the leaks, return all solenoids to the AUTO position.

VIII. CALIBRATION SETUP & OPERATION, ZR402G

8.1 ZR402G TOUCH PANEL SWITCH OPERATIONS

The converter uses a touch panel switch which can be operated by just touching the panel display. Figure 8.1 shows the basic panel display. The switches that appear in the switch display area vary depending on the panel display, allowing all switch operations. Figure 8.2 shows the switch functions.

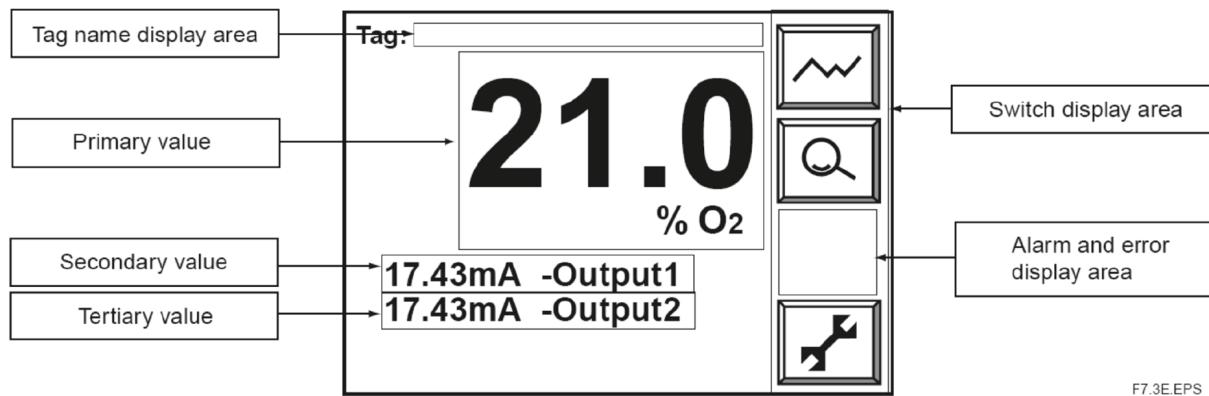


FIGURE: 8.1

Tag name display area: Displays the set tag name (Refer to Section 10.1.4, “Entering Tag Name”).

Primary to tertiary display items: Displays the selected item. (Refer to Section 7.9, “Setting Display Item”.)

Switch display area: Displays switches and functions selected according to the panel display.

Alarm and error display area: Displays an error if an alarm or error occurs. If you touch this area, the details of the error or alarm are then displayed.

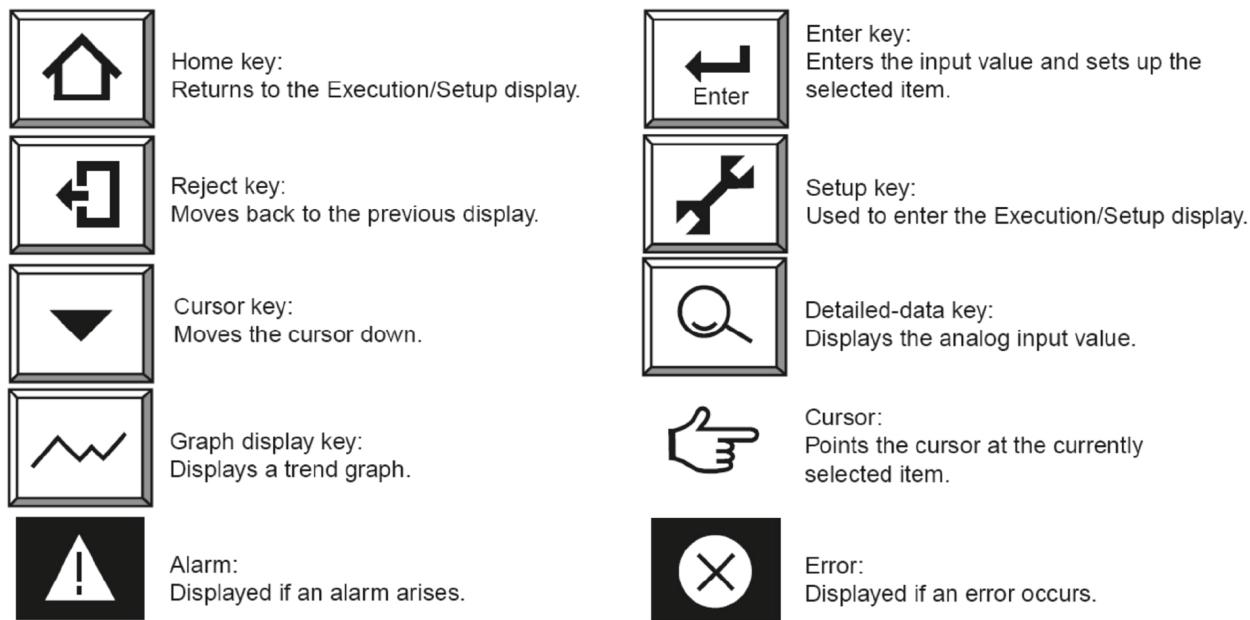


FIGURE: 8.2

8.2 CALIBRATION

The converter is calibrated in such a way that the actual zero and span gases are measured and those measured values are used to agree with the oxygen concentrations in the respective gases. There are three types of calibration procedures available:

Manual calibration: conducting zero and span calibrations, or either of these calibrations in turn. Manual calibration needs the MC1 Manual Calibration Unit to allow manual supply of the calibration gases.

Semi-automatic calibration which uses the touch panel or a contact input signal and conducts calibration operations based on a preset calibration time and stable time.

Automatic calibration conducted at preset intervals. Semi-automatic and automatic calibration needs the AC1 Automatic Calibration Unit to allow automatic supply of the calibration gases. The following sections set forth the manual calibration procedures. For details on semi-automatic and automatic calibrations, consult Chapter 9, "Calibration," in the ZR22G/ZR402G Instruction Manual.

8.2.1 MODE SETTING

For the mode setting, do the following:

- 1) Press the Setup key in the basic panel display to display the **Execution/Setup** display.
- 2) Select **Maintenance** in the Execution/Setup display to display the Maintenance panel display.
- 3) Then select **Calibration setup** to display the Calibration setup display as Figure 8.3 shows.
- 4) Select Mode in this panel, and then select "**Manual**," "**Semi-Auto**" or "**Auto**."

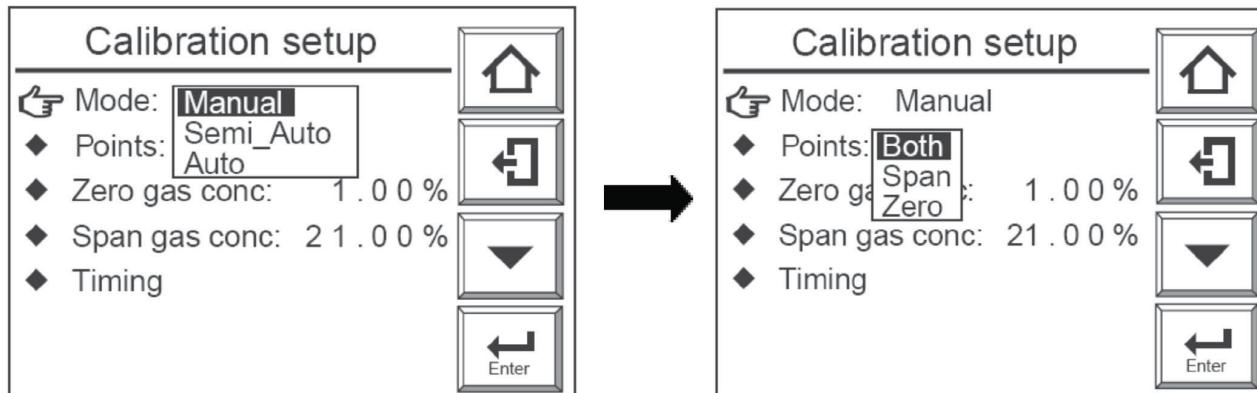


Figure 8.3

8.2.2 ZERO-GAS CONCENTRATION

Set the oxygen concentration for zero-point calibration. Enter the oxygen concentration for the zero gas in the cylinder used in the following procedures:

- 1) Select Zero gas conc. from the Calibration setup display. The numeric-data entry display then appears.
- 2) Enter the desired oxygen concentration for the zero-point calibration. (The zero-gas set ranges from 0.3 to 100 %O₂.)
- 3) Enter 00098 for an oxygen concentration of 0.98 vol % O₂.

8.2.3 SPAN-GAS CONCENTRATION

Set the oxygen concentration for span calibration. If instrument air is used as the span gas, enter 21 %O₂.

- 1) Select Span gas conc. from the Calibration setup display.
- 2) Enter the desired span-gas oxygen concentration from the numeric-data entry display. (The span-gas set ranges from 4.5 to 100 %O₂.)
- 3) Enter 02100 for an oxygen concentration of 21 vol%O₂. Instrument air is here defined as dry air with a dew-point temperature of no higher than -208°C.
If the dew-point temperature is higher than -208°C, use a hand-held oxygen analyzer to measure the actual oxygen concentration.



CAUTION

- (1) When instrument air is used for the span calibration, remove the moisture from the instrument air at a dew-point temperature of -208C and also remove any oily mist and dust from that air.
- (2) If dehumidifying is not enough, or if foul air is used, the measurement accuracy will be adversely affected.

8.3 MANUAL CALIBRATION

For manual calibration, consult Section 7.12, "Calibration," In the ZR22G / ZR402G Instruction Manual (IM 11M12A01-02E)

8.4 SEMI-AUTOMATIC CALIBRATION

To start calibration, follow these steps:

- (1) Press the Setup key in the basic panel display to display the Execution/Setup display.
- (2) Then select Calibration from the Execution/Setup display. The Calibration display shown in Figure 8.4 appears.
- (3) (2) Select Semi-auto calibration to display the Semi-automatic calibration display shown in Figure 8.4
- (4) (3) Select Start calibration. The display shown in Figure 8.4 appears, and then start calibration.

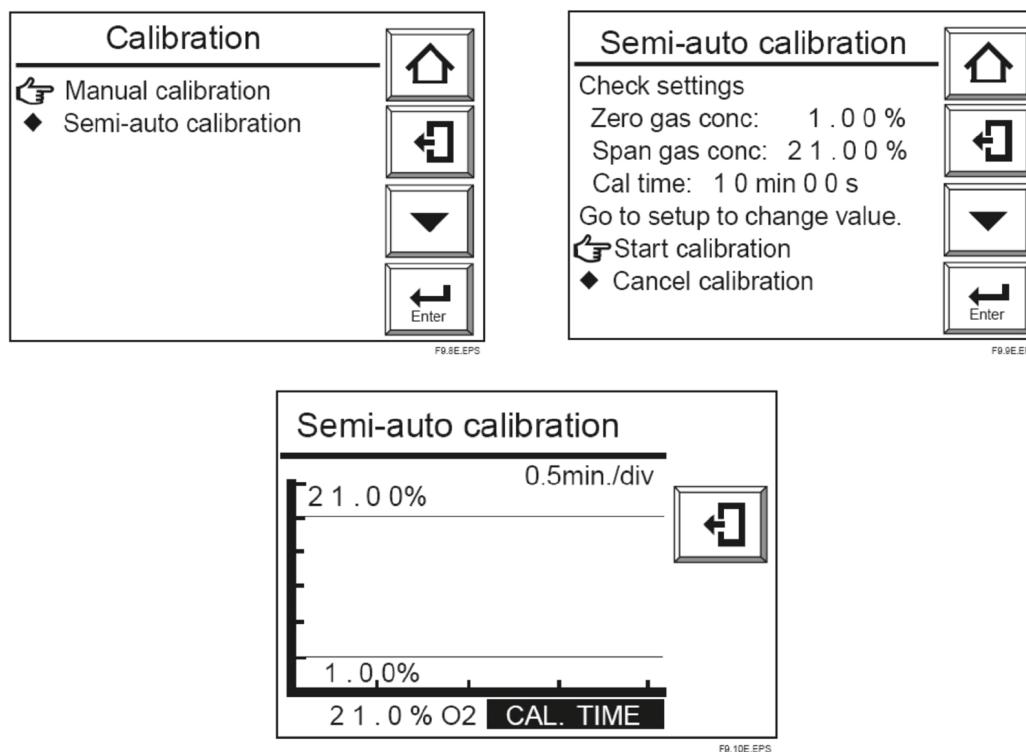


Figure 8.4

To start calibration using an input contact, follow these steps:

- (1) Make sure that Calibration start has been selected in the Input contacts display
- (2) Apply an input contact to start calibration.

To stop calibration midway, follow these steps:

- (1) Press the Return key. If this key is pressed midway during calibration, the calibration will stop and the output stabilization time will be set up.
- (2) Press the Return key once again to return to the basic panel display and the analyzer will be in normal measurement.

8.5 AUTOMATIC CALIBRATION

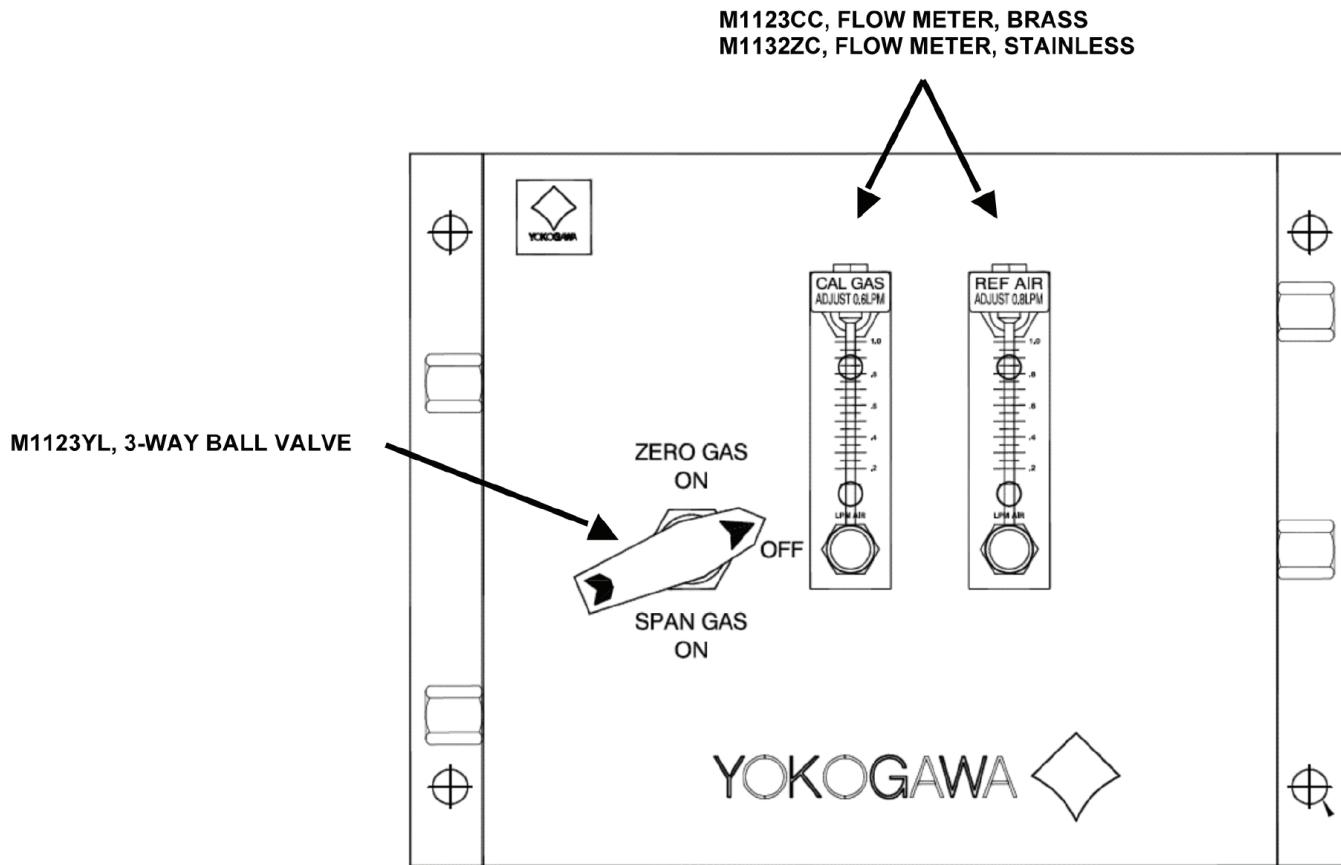
No execution operations are required for automatic calibration. Automatic calibration starts in accordance with a preset start day and time. Calibration is then executed at preset intervals.



Before conducting a semi-automatic or automatic calibration, run the automatic calibration unit beforehand to obtain a calibration flow of $600 \pm 60 \text{ ml/min}$.

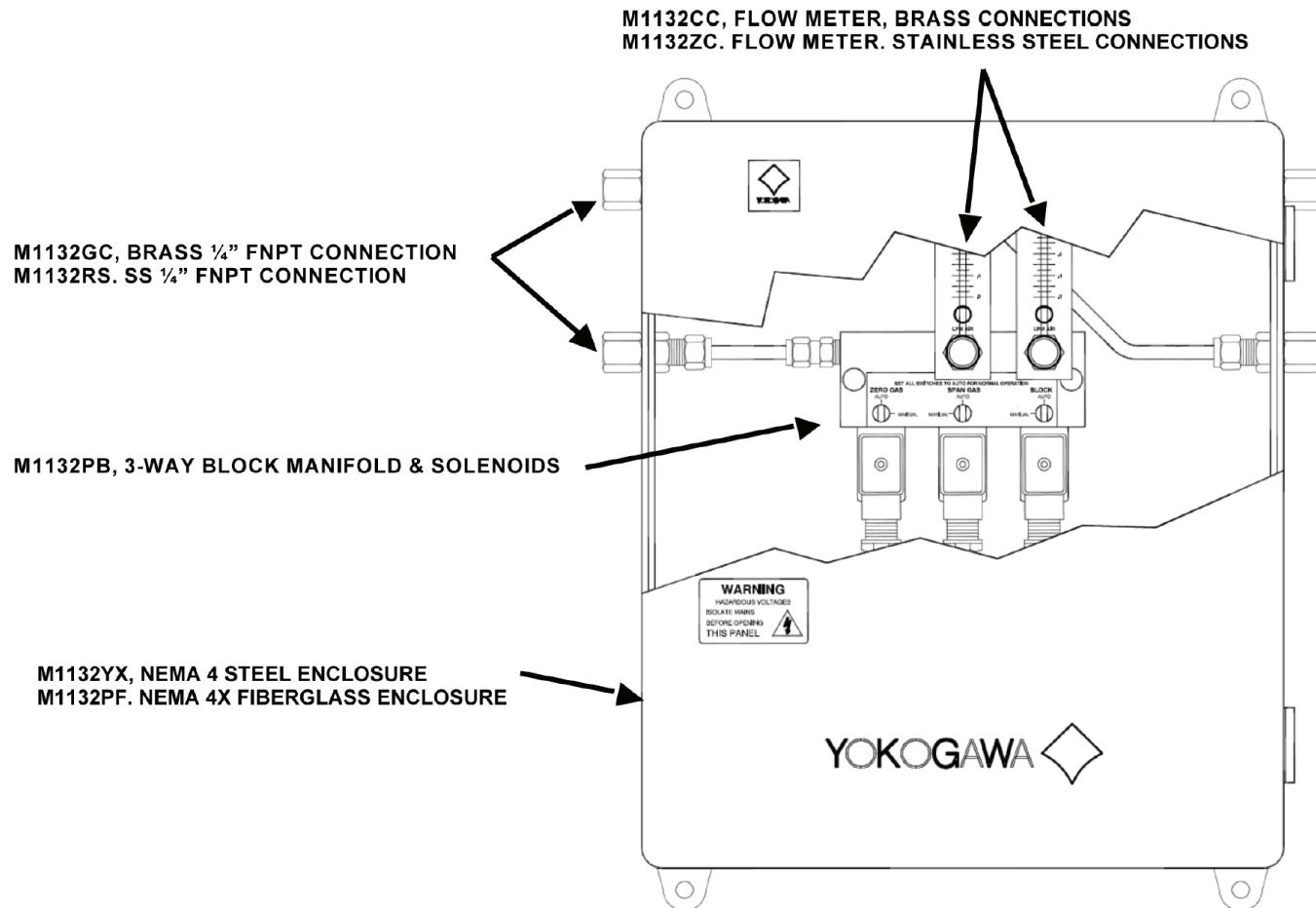
APPENDIX A SPARE PART

MODEL MC1



1. M1132CC Flow meter, Brass (2)
M1132ZC Flow Meter, SS (2)
2. M1123YL 3-Way Ball Valve (1)
3. M1132GC BRASS 1/4" FNPT CONNECTION (4)
M1132RS SS 1/4" FNPT CONNECTION (4)

MODEL AC1



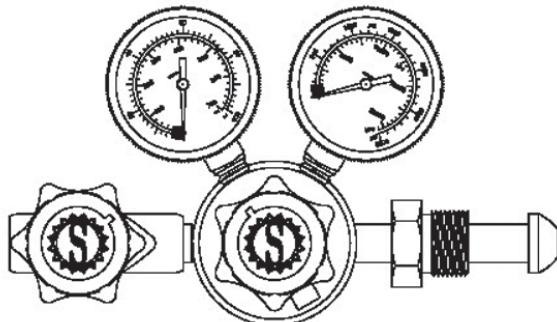
1. M1132YX NEMA 4 STEEL ENCLOSURE (1)
2. M1132PF NEMA 4X FIBERGLASS ENCLOSURE (1)
3. M1132PB 3-WAY BLOCK MANIFOLD & SOLENOIDS (1)
4. M1132CC FLOW METER, BRASS CONNECTIONS (2)
5. M1132ZC FLOW METER, SS CONNECTIONS (2)
6. M1132GC BRASS 1/4" FNPT CONNECTION (4)
7. M1132RS SS 1/4" FNPT CONNECTION (4)

Zero Gas Regulator, M1132ZX

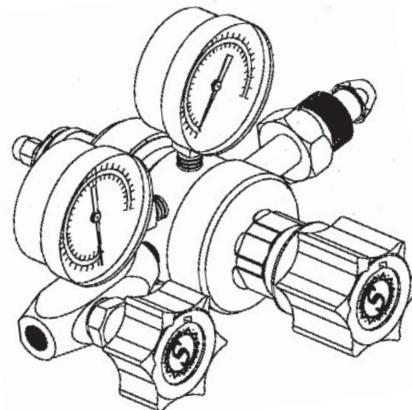
This regulator controls the gas pressure of the zero gas cylinders before it reaches the calibration unit. The dual stage regulator is highly recommended for services which require a near constant delivery pressure as the calibration source decays (See M1133AR). Air diffusion and absorption, desorption and off gassing are minimized because of its stainless steel construction.

NOTE

This regulator is used on a "zero gas" cylinder with a CGA 580 connection. The Cylinder connection must be CGA580 (used for <5% oxygen balanced in nitrogen).



FRONT



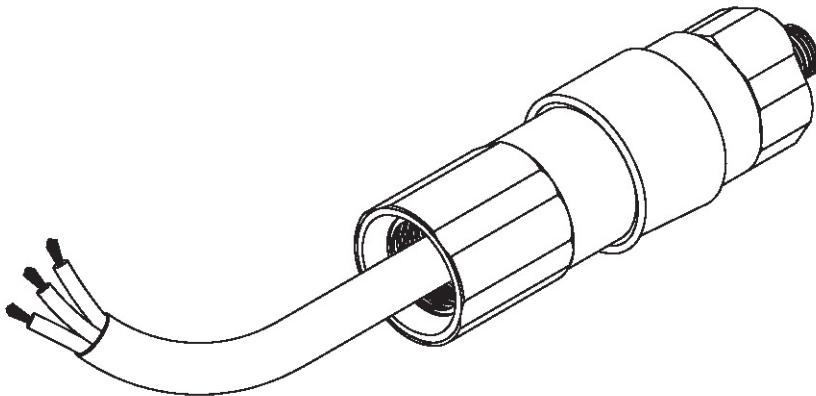
ISOMETRIC

Zero Gas Regulator, M1132ZX

Maximum Inlet Pressure:	3,000 psig
Operating Temperature Range:	-40°F to 200 °F
Bonnet Vents:	1/8" NPTF
Inlet/Outlet Connection:	CGA 580 with 1/4" NPTM
Purge Ports:	1/4" NPT Female
Weight:	4.7 lbs (1.75 kg)
Material of Construction:	Body - 316L Stainless Steel Diaphragm - 316L Stainless Steel Seat/Seal - Tetzel/Teflon, Kel-F Gauges - 316L Stainless Steel Bonnet - brass, nickel-plated
Delivery pressure Range:	2 to 75 psig
Flow Capacity Air:	300 scfh
Gauges:	Delivery, 0 to 100 psig; Cylinder pressure, 0 to 3,000 psig 2" diameter

Zero Pressure Switch, M1133AR

The pressure switch is used to alert the Operator via a contact input that the zero gas cylinder needs to be replaced before the cylinder is empty. The recommended connection is to the high pressure side of the zero gas regulator. Refer to Figure 4.1.



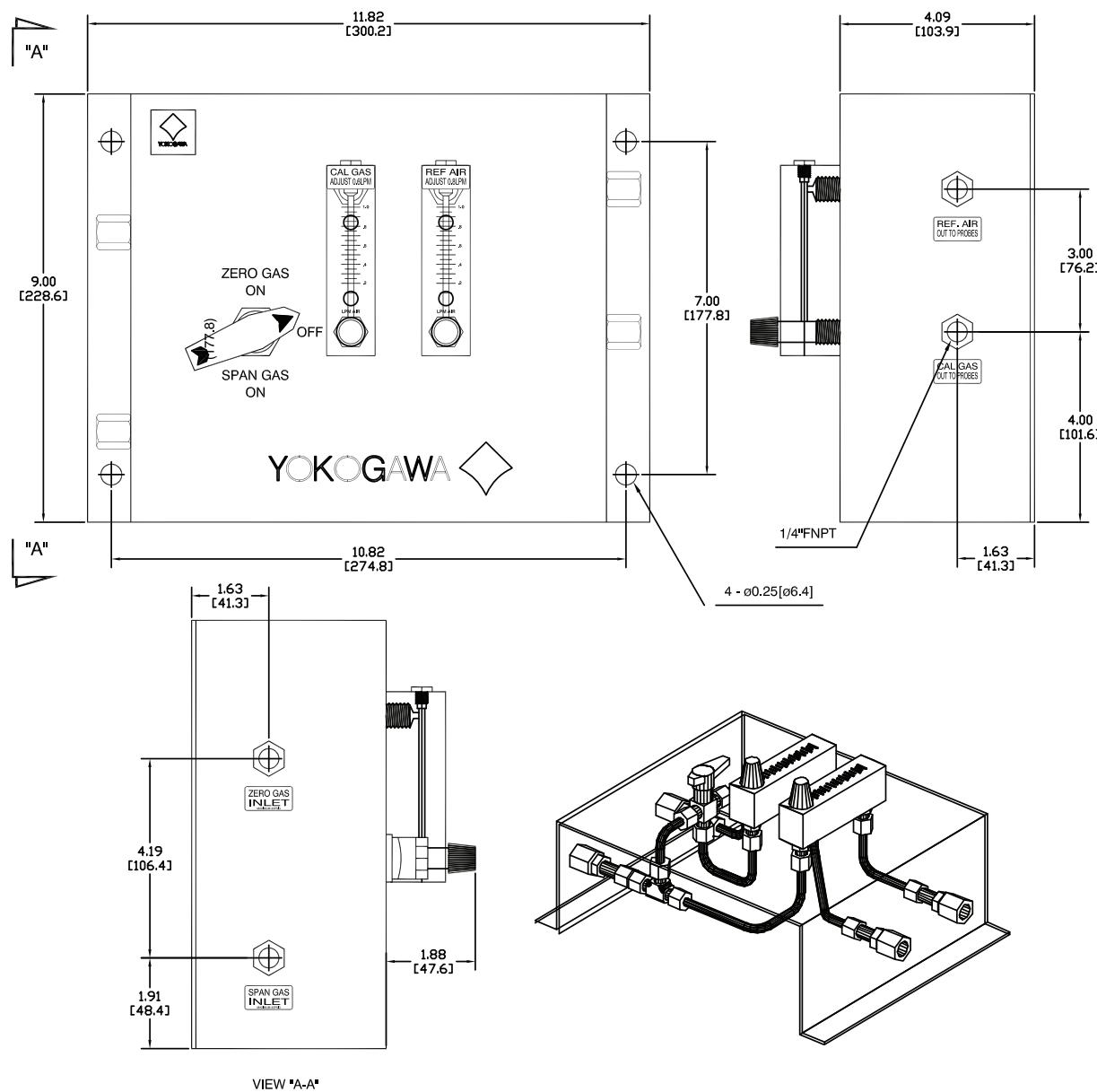
Zero Pressure Switch, M1133AR

Adjustable Set Point Ranges:	30 to 575 psi on fall; 50 to 600 psi on rise.
Dead Band:	8 to 60 psi
Over Range:	2,500 psi
Proof Pressure:	3,000 psi
Storage Temperature:	-40°F to 180°F (-40 °C to 82 °C)
Ambient Temperature:	0 °F to 160 °F (-18 °C to 71 °C)
Set Point Repeatability:	1% of span
Switch Output:	One SPDT (either NC or NO)
Electrical Rating:	Rated to 5 amps resistive and 15 amps inductive (75% PF), at 125 and 120 VAC, 1/4" HP
Enclosure:	Aluminum with irradiate finish rated for 100 hours of salt spray
Electrical Connection:	One SPDT output; 1/2" NPTF, 5ft cable
Pressure Connection:	1/8" NPTM
Mounting:	NPTM pressure connection
Weight:	12oz (340g)
Approvals:	UL 508 listed, E42272; CSA C22.2, No 14-1987: LR 9690

APPENDIX B

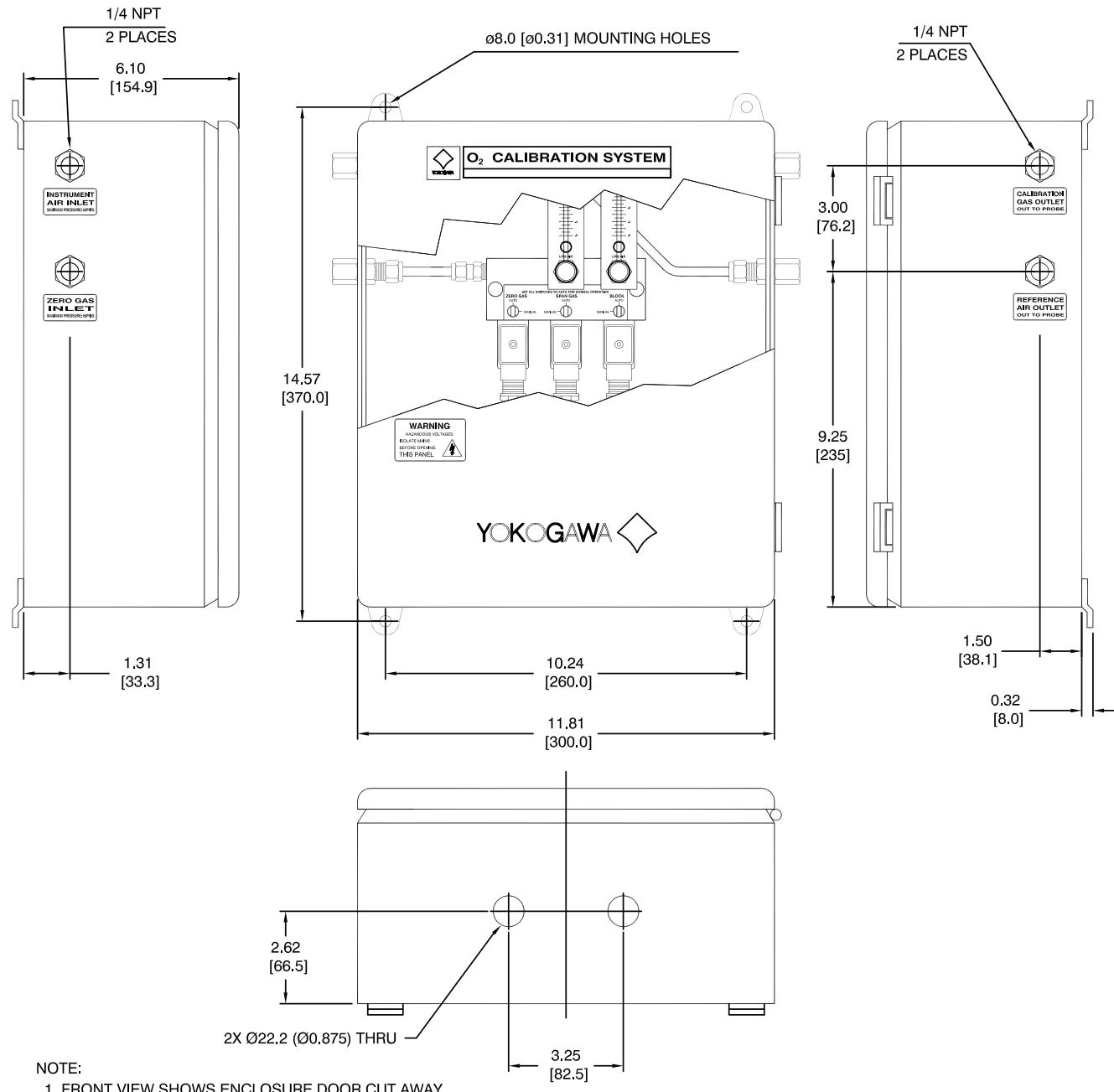
DIMENSIONAL DRAWINGS

MC1



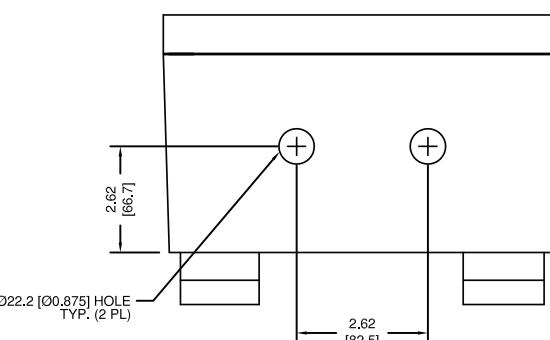
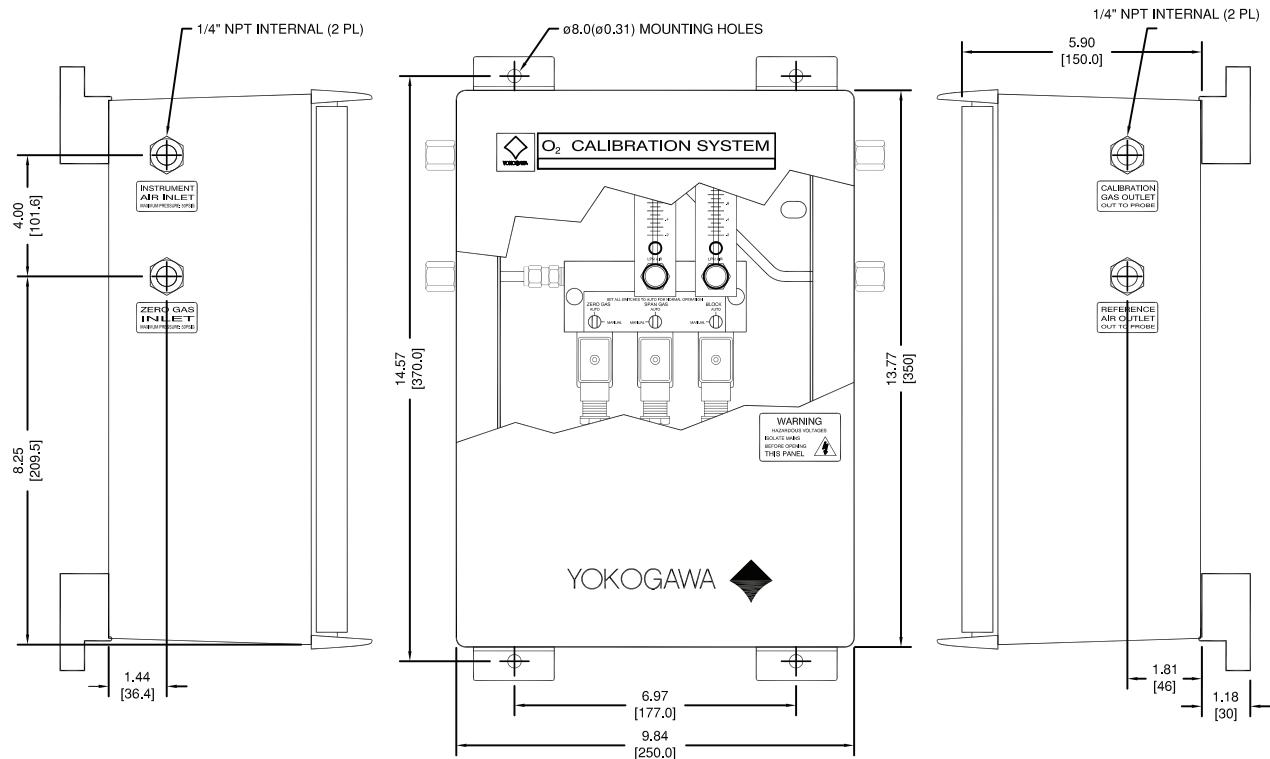
MC1

AC1-4 NEMA 4



AC1-4, with NEMA 4 Enclosure

AC1-5, NEMA 4X



NOTE:
 1. FRONT VIEW SHOWS ENCLOSURE DOOR CUT AWAY
 TO ALLOW VIEWING OF INSIDE.
 2. DOOR HINGED ON LEFT SIDE.

AC1-5, with NEMA 4X Enclosure

APPENDIX C

WIRING DIAGRAM

